

US NAVY WEAR TEST AND USER EVALUATION OF COMMERCIAL SAFETY SHOES



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Natick, Massachusetts**

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Executive Summary

Results from a Navy Clothing and Textile Research Facility (NCTRF) survey of wearers of the *standard issue chukka shoe* indicated that both men and women have problems with fit and serviceability. As a result, NCTRF recommended that the standard Chukka shoe be replaced as soon as possible. A commercial market survey was undertaken and two commercial safety shoes were identified as being acceptable replacements. Each of these shoes came in two styles, one for men and one for women. This report details the user testing of these shoes.

The main purpose of the user test was not to compare the commercial shoes with the standard issue Chukka shoe, but to identify any potential medical, durability, and/or user acceptance problems with the male and female versions of each shoe. The candidate shoes were tested with three Navy populations: four divisions of new recruits at the Recruit Training Center (RTC), Recruit Division Commanders (RDC) at the RTC, and U.S. Navy personnel aboard three fleet ships.

RTC

At the RTC, 224 recruits participated in the test. Shoes were worn for a total of eight weeks, with each recruit receiving only one type of shoe. The recruits responded to three user surveys at the end of two, five, and eight weeks.

It was found that the commercial shoes were rated positively for almost all criteria, and were received favorably by the recruits. When comparing the two commercial shoes, very few differences were found. Most differences that were identified tended to be minor: for example, differences in ratings between "fair to good" and "good". The only major durability problem was the complete or partial separation of the heel from the shoe, which occurred with 23% of the recruits. Ventilation of the shoes was also a source of complaint, with 40% of recruits stating that their feet perspired and remained wet.

RDC

Originally, 72 RDC leaders were issued both pairs of commercial shoes, and wore each pair for three weeks. This study was aimed at comparing the two commercial shoe candidates. One user preference survey was completed for each of the candidate shoes. In addition, a comparison survey was administered after the RDCs had worn both pairs of shoes. No real differences were found between the two commercial candidates. Both shoes received positive ratings on all criteria. In addition, no durability problems were identified. However, the lack of ventilation was identified as a problem by about 30% of the wearers of both shoes.

Shipboard

Navy personnel aboard three ships were each issued one pair of commercial shoes. This component was designed to provide data from users in a shipboard setting. A total of 124 pairs of shoes were issued and were worn for eight weeks. A user preference survey, similar to the RTC and RDC surveys, was administered at the end of the test period. Again, no real differences were

identified between the two commercial shoes, and again, both shoes were rated positively on all criteria. Heel separation was the only durability problem occurring with 9% of the wearers. Ventilation was also a problem for approximately 24% of the wearers.

In conclusion, the wear test found that the commercial shoes from the Bates and the Craddock-Terry manufacturers performed well, and were generally liked by U.S. Navy personnel.

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Introduction

The Chukka shoe has been a U.S. Navy item of standard issue for over 40 years. It is a black safety shoe, incorporating steel toe caps and nitrile rubber soles and heels. Prompted by unofficial reports of poor fit and discomfort, the Navy Clothing and Textile Research Facility (NCTRF) conducted a user survey in 1995. The survey found that both men and women had problems with: fit and serviceability; stiffness; weight; poor arch and ankle support; poor accommodation of women, and general discomfort. Survey respondents stated that they would like shoes with padded ankles, more arch support, better traction, and increased durability. Consequently, a commercial market survey (CMS) was conducted to identify a suitable shoe.

Two shoes were identified from the CMS, manufactured by two companies, *Bates* (Bates) and *Craddock-Terry* (CT). Bates and CT had originally produced their shoes to meet requirements for features such as steel toes, ankle support, nitrile rubber soles, water resistance, etc. Both companies produced their shoes in male and female styles.

The primary purpose of these studies was to identify any possible problem areas with the shoes and to confirm their suitability for Navy training and operational use. The goal was not to compare the shoes with each other, nor to downselect to one candidate, as both ECSs were identified by the Navy as meeting the requirements for Chukka shoes. The evaluation of the Enhanced Chukka Shoe (ECS) was conducted with three different Navy populations: recruits at the Recruit Training Center (RTC), Recruit Division Commanders (RDC) at the RTC, and sailors from three ships (USSs Deyo, Gunston Hall, and Shenandoah).

The largest component of the wear test was conducted at the RTC, using four divisions of recruits (two female divisions and two male). Two divisions, one female and one male, received the Bates shoe while the other two, received the CT shoe. Each recruit wore only one pair of shoes for the duration of their training.

The shipboard component, like the RTC, was concerned with identifying possible problem areas. Therefore, each participant received one pair of shoes for the entire wear period. Test participants onboard the USS Shenandoah were issued CT shoes, those onboard the USS Gunston Hall were primarily issued Bates ECS, while approximately half the sailors on the USS Deyo received the Bates shoes and the remainder CT.

The RDC study was designed to allow for a direct comparison of the Bates and CT shoes for both the male and female styles. The RDC participants were issued a pair of shoes from both companies and wore each for a continuous three-week period.

This report details the three components of the ECS wear test, examining the performance of the shoes in training and operational environments, and provides an assessment of the suitability of the shoes for the Navy as a whole.

Methodology

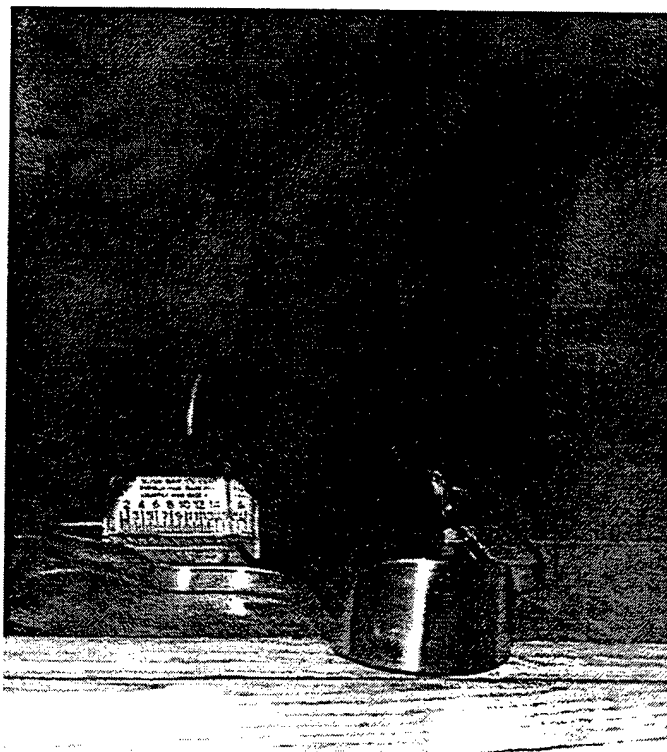
Experimental Design (General)

In all three studies, six major factors were measured: fit, wearers' ability to perform activities, comfort, medical problems, durability, and acceptability. All data were collected by questionnaire, and personal interview when appropriate. All studies used nearly identical surveys, with only minor modifications to account for the differences found between shore and sea duty, and the RDC study utilized an additional comparison survey. The RTC, RDC and shipboard preference surveys can be found in Appendices A, B, and C, respectively. The RDC comparison survey can be found in Appendix D.

Fitting of ECS

Test participants were sized by representatives from the two shoe manufacturers using the Brannock device to estimate the length and width size of both feet. Figure 1, shows a RTC recruit being sized using a Brannock device. This was a critical step of the evaluation, since an improper fit could adversely affect many factors such as: the performance of the individual, perceptions of comfort, acceptance, and even durability.

Figure 1: Sizing Using the Brannock Device



Individuals tried on a pair of ECSs based on their estimated shoe size as measured by the Brannock device. Participants donned the ECSs and the fit was evaluated by the shoe manufacturer's representative. If not satisfactory, additional sizes were tried until a proper fit could be attained. A test participant was not issued a pair of ECSs until the fit was acceptable to both the fitter and the recruit (See Figure 2). A demographic data sheet was completed for each participant, which listed the measured size, the issued size, and problems with users' feet or shoes. (See Appendix E)

Figure 2: Checking Fit of Shoe



Recruit Training Center - Recruit Study

Methodology

Subjects

Four companies of the RTC were identified to take part in this test: a male and female test group wearing the Bates shoe, and a male and female test group wearing the Craddock-Terry shoe. A total of 350 test shoes were issued initially to recruits at the RTC. Of this group, 224 recruits completed all three stages of the wear test, 116 in the Bates group and 108 in the Craddock-Terry group.

Design and Procedures

Each recruit received one pair of ECSs, either the Bates or the CT. Once sized and approved, individuals participated in regular recruit training. During this eight-week period, test participants were surveyed three times to elicit their feedback on the ECS. The surveys were administered at three intervals: two, five, and eight weeks.

At the three survey points, the test participants were divided into four groups, by shoe type and gender, and administered surveys. Test participants were then briefed on the purpose of the evaluation and the importance of their participation. During each questionnaire administration, the testers inspected any shoes with reported damage.

During the course of the eight-week test period, ECSs with defects or fit problems were turned in and documented with a questionnaire form (See Appendix F). ECSs were turned in only when the recruit deemed them unwearable.

In addition to the recruits' questionnaire data, supplemental data were obtained from RTC physicians who documented any foot problems which occurred during the test period. The purpose of collecting these data was to compare the number and severity of problems associated with the candidate shoes to the average number of problems associated with the standard Chukka shoe. The outcome of this inquiry will be discussed in the Results Section.

Results

a. Data Analysis

Data collected during surveys #1 through #3 of the study were summarized and analyzed using standard statistical procedures. For the experimental design, most variables, such as ratings over time, were analyzed using a standard repeated measures analysis of variance (ANOVA). The scaled data were analyzed with consideration to the following factors: shoe type, gender, ECS size, survey number (survey #1, survey #2, and survey #3), and interactions between these factors. Follow-up post hoc tests determined the factors that were statistically different. Results were deemed significant when the confidence level was equal to or greater than 95% ($p \leq 0.05$).

To further analyze significant differences identified by the ANOVAs, the ratings scale data of the two test shoes were compared using t-tests. The t-test compared the means received from the Bates and CT ECSs. When using the t-test to compare scores received from the three surveys, the 0.05 criterion level for individual t-tests was adjusted for "family-wise" error rate by utilizing the Bonferroni correction for multiple comparisons.

Also, tests of proportions on dichotomous data with consideration to gender, shoe size, and time duration were performed using the chi-square (χ^2) statistical test. Open-ended responses were tallied by shoe type and survey period. All scaled data were summarized in tables found in Appendix G. The data were summarized according to shoe type and survey number as no gender differences were detected for any of the test factors.

b. Demographics

The companies from the RTC that participated in this evaluation were randomly chosen. The average age of recruits was 20 years old, with the range between 18 and 28 years of age. The number of recruits participating in each survey is broken down in Table 1 by gender and ECS group.

Table 1: Recruit Participation by Survey

	Survey 1			Survey 2			Survey 3		
Gender	M	F	Total	M	F	Total	M	F	Total
Bates	73	55	128	72	49	121	67	49	116
CT	56	52	108	67	42	109	68	48	116

M=male recruits; F=female recruits

The variation in the number of recruits participating in each survey is a result of dropouts from the program, and the unavailability of recruits during survey times. In addition, some test participants turned in their boots due to damage that occurred between the second and third surveys, and therefore, did not complete the test.

Of the total test group, 97% wore their ECSs every day for over 10 hours a day. The remaining 2% of the recruits from the Bates group and 1% of the recruits from the CT group substituted sneakers briefly during the test due to foot and leg problems. These medical problems were unrelated to either ECS.

The vast majority of participants wore two pairs of socks with their ECSs: one pair of white athletic socks, and one pair of black issue socks. Many individuals stated they wore this sock combination because it was mandatory for recruits, while others stated that the combination offered comfort and prevented blisters.

The practice of adding inserts increased for both types of shoes over the course of this test, with the majority of the recruits reporting the use of Dr.Scholl's insoles and Odor Eaters. Overall, the increase in insert usage rose from 20% of the recruits in survey #1 to 38% by survey #3. Significantly more inserts were added to Bates shoes during the first weeks of the evaluation than were added to the CT shoes ($\chi^2=13.96$, $df=1$, $p<.001$). By the third survey, the CT shoe wearers had increased their insert usage, and were equal to the Bates wearers. It is interesting to note that while the Bates wearers steadily increased their use of inserts, the number of CT wearers who added inserts remained low for surveys #1 and #2 but quadrupled by survey #3.

It is unclear why the Bates wearers added inserts sooner than the CT wearers, especially when considering that by the eighth week both groups were equal in insert usage. However, it is common practice for company commanders to advise recruits to add inserts to their issue shoes. While it is unclear how many of the RTC group were advised to add inserts, this practice may account for the insert usage by the Bates and CT wearers. Table 2 below demonstrates the increases within each ECS type.

Table 2: Number of Inserts Used by Survey

	Bates	CT
Survey #1	36 (29%)	10 (09%)
Survey #2	40 (33%)	10 (09%)
Survey #3	50 (43%)	38 (43%)

Of those adding inserts to their ECSs, three reasons were offered by users of both candidates. Individuals most often added inserts to increase the comfort, cushioning, and arch support of their shoes. As demonstrated in Table 3, a greater proportion of the Bates group than the CT group reported experiencing problems with their shoes, which lead them to purchase inserts.

Table 3: Reasons for Additional Inserts

	Bates N=36 (28%)	CT N=16 (15%)
Additional Cushioning	11	3
Additional Comfort	7	6
Additional Arch Support	3	2

c. Fit Assessment

Eight factors were measured to assess the fit of the shoe: ease of donning, ease of doffing, fit of ankle, fit of toes, fit of heel, fit of instep, arch support, and ankle support. When looking at the consistency of responses for fit criteria across the three surveys, very few differences were detected. There was one difference found with the CT shoe with respect to fit. The ability to don the CT shoe was rated significantly easier during the first test period than it was during survey #2 ($F=5.19$, $df=2, 122$, $p<.007$). It should be noted that responses received from all three surveys for the CT shoes fell in the "easy" to "fairly easy" categories.

When comparing the Bates and the CT shoes within each test period on fit criteria, consistent differences between the two ECSs were detected. For all three surveys, the Bates shoe was rated significantly easier to don than the CT shoe ($t=-4.73$, $df=213$, $p<.001$; $t=-7.33$, $df=220$, $p<.001$; $t=-6.55$, $df=213$, $p<.001$, respectively). Seventy-nine percent ($n=85$) of the CT group experienced a problem donning the ECS, compared to the 32% ($n=37$) of the Bates group. Respondents were asked to explain the problems they had donning their ECSs. Breaking down the responses by ECS candidate, Table 4 provides the total number of complaints, and the most common complaints for each shoe.

Table 4: Donning Complaints by Shoe

	Bates N=116	CT N=108
TOTAL NUMBER OF PROBLEMS	37 (32%)	85 (79%)
Unlace to don	13 (11%)	27 (25%)
Heel/Ankle tight	8 (7%)	18 (17%)
Tongue/Instep tight	2 (2%)	17 (16%)

Similar results were obtained for doffing the ECS candidates, where the Bates shoe was rated as significantly easier to doff than the CT shoe for all three surveys ($t=-3.86$, $df=211$, $p<.001$; $t=-5.97$, $df=219$, $p<.001$; $t=-5.16$, $df=213$, $p<.001$, respectively). The Bates shoe was consistently rated as "easy", where the CT shoe was rated as "fairly easy" for doffing. Table 5 lists the total number of complaints for each ECS and the top three complaints for each shoe. The table shows that 41% ($n=44$) of the CT group experienced a problem doffing the ECS, compared to 16% ($n=18$) of the Bates group.

Table 5: Doffing Complaints by Shoe

	Bates N=116	CT N=108
TOTAL NUMBER OF PROBLEMS	18 (16%)	44 (41%)
Unlace to doff	11 (9%)	19 (18%)
Heel/Ankle tight	3 (3%)	10 (9%)
Tongue/Instep tight	1 (<1%)	4 (4%)

No differences were identified between the two shoes when rating the fit of specific areas of the foot. The fit of the ankle, toes, heel, and instep was rated as "just right" by the Bates and CT wearers. The same rating was received by both groups of ECS wearers when evaluating the overall fit. The shoes were also rated equally for ankle support, with both shoes receiving a "good" rating. However, the ECS candidates were both rated as "fair" for arch support on all surveys.

d. Ability to Perform Activities

The performance of the test shoes was measured by the users' ability to walk, run, march, and stand. An interesting trend appeared in users' ratings of standing and marching in the two ECS candidates. The ratings received from Bates wearers for these two activities demonstrated an increase in performance over time, while the CT wearers' ratings of performance decreased over time.

The ratings received for standing in the Bates shoe rose significantly between survey #1 and survey #3 ($F=4.11$, $df=2,116$, $p<.02$) from "fair" to "good". Again, this could be the result of the increase in insert usage in the Bates group. The Bates group's ratings for walking, running, and marching were positive and consistent during the evaluation. Conversely, the CT ECSs ratings for users' ability to run, significantly decreased between survey #1 and survey #2 ($F=3.60$, $df=2, 114$, $p=.03$), and decreased for marching between surveys #1 and #3 ($F=4.33$, $df=2,188$ $p<.02$). The ability to walk while wearing the CT shoes was consistently positive for the three surveys.

Similarly, when comparing the two ECS candidates within each survey period, there were no differences in the ratings received for the two ECSs for ability to walk, run, or march. For ability to stand, the Bates shoe received a significantly higher rating compared to the CT shoe ($t=2.74$, $df=213$, $p=.007$; $t=4.84$, $df=220$, $p<.001$; $t=4.86$, $df=213$, $p<.001$). The CT shoe was rated as "fair" for standing in throughout the test, while the Bates shoe increased from "fair" in survey #1 to "good" in surveys #2 and #3. Table 6 below illustrates the ratings received for the performance criteria.

Table 6: Average Ratings of Recruits' Ability to Function

	BATES SHOE			CT SHOE		
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
Ability to Stand	2.46	2.64	2.68	2.23	2.27	2.27
Ability to Walk	2.69	2.79	2.81	2.85	2.78	2.75
Ability to Run	2.19	2.25	2.29	2.33	2.06	2.12
Ability to March	2.60	2.73	2.75	2.82	2.77	2.62

Rating Scale: 1.00=POOR 2.00=FAIR 3.00=GOOD

The traction of each candidate ECS on a variety of surfaces was also investigated during this evaluation. No differences were found between the two shoe types, and all ratings indicate no problems traversing any of the surfaces, as Table 7 demonstrates.

Table 7: Traction Ratings for Common Surfaces

	Bates	CT
Wet/Moist	2.80	2.67
Oil Covered	3.40	3.46
Waxed	2.67	2.81
Nonskid	2.98	3.09
Painted	3.24	3.27
Grass	3.21	3.38
Mud	3.15	3.12
Pavement	2.92	2.90
Carpet	3.37	3.40
Wooden Surface Floors	3.28	3.31

1.00=Poor, 2.00=Fair, 3.00=Good

e. Comfort

Test participants were asked to rate the comfort of the shoes on three factors: break-in period, ability of shoes to keep feet dry, and thermal comfort. The most prominent factor when measuring the comfort of the ECSs is the break-in period. There was little difference in the time necessary to break in the ECSs. Both groups reported wearing the ECSs an average of six times before they were broken in. There were a large number of individuals from each of the shoe groups who did not feel the ECSs needed to be broken in at all, 31% from the Bates group (N=40) and 25% from the CT group (N=27). Few individuals felt that the ECSs could not be broken in at all; 3% of the Bates group (N=4), and 6% of the CT group (N=6).

The majority of the ECSs became wet (N=154, 66%) during ordinary RTC training. When this occurred, 96% of the ECSs kept the wearers' feet dry. Again, there were no differences between the water resistance of the two candidate ECS. The drying time of the ECSs was also equal in both groups. Users reported that the shoes dried completely in one to three hours. The only method used for drying the ECSs was air-drying. In addition, users' ratings of the thermal comfort of the two candidate shoes were equal, with the Bates and CT shoes both rated as "just right" on all three surveys. However, perspiration from wearing the ECSs caused nearly half the group to respond that their feet stayed wet (N=107, 48%). This ventilation problem occurred equally within each ECS type.

f. Medical Problems

A list of common foot problems associated with footwear was provided to test participants who indicated which ones, if any, they had experienced. Table 8 details these foot problems. Statistical tests determined that there were no differences in the incidence of foot problems between the ECS types.

Table 8: Reported Foot Problems Associated with ECS

	Bates n=219	CT n=242
Foot Problems Experienced:		
Blisters	45% (53)	46% (54)
Aching feet	42% (49)	50% (58)
Callouses	41% (48)	38% (44)
Foot cramps	21% (24)	26% (30)
Aching legs	21% (24)	26% (30)
Aching back	11% (13)	12% (14)
Other	7% (8)	10% (12)

In addition to this data received from the recruits, supplemental data were received from medical personnel. A breakdown by ECSs and type of foot problem of individuals who received medical attention is located in Appendix H. A memorandum was also furnished by medical personnel discussing the rate of problems associated with the standard Chukka versus the incidence of foot problems associated with the prototype ECSs. The podiatrists concluded that the test boots are superior to the standard Chukka shoe in construction and design, and reported no increase in the incidence of foot problems experienced by the recruits. This memorandum can be found in Appendix I.

g. Durability

Approximately 81% of the group (N=182) reported some type of damage to their ECSs; 105 recruits from the Bates group and 77 from the CT group. The severity of the damage ranged from eyelet paint chipping off to heels separating from the ECSs. The damage reported from each shoe group is listed in Table 9 along with the number of individuals experiencing the problem.

Table 9: Reports of Damage for Both ECS Candidates

	Bates n=105	CT n=77
Type of durability problem:	n	n
Heel separating	9	2
Heel came off	8	8
Unspecified heel problem	10	4
Scuff/tear toe area	20	18
Eyelet paint wearing off	58	45

As Table 9 demonstrates, the most common durability problems associated with the ECSs were the peeling of the eyelet paint and the scuffing and/or tearing of leather in the toe area. When shoe damage was analyzed by size, it was equally spread across all sizes for both of the shoe candidates. This demonstrates that no one particular shoe size differed from the others in its construction and durability. Also, when comparing the damage reports between males and females, the female damage reports were proportional to the number of females who participated in each ECS group. In summary, there were no ECS group differences or gender differences on the reported damage to the shoes.

Despite the reports of damage listed above, few ECSs were actually turned in. Damaged ECSs were replaced only during the first three weeks of the evaluation. After this time, individuals were requested to turn in damaged ECSs for inspection at the next survey, and their standard Chukka shoes were reissued to them. According to the Defect Sheets (See Appendix F) collected, three CT ECSs were turned in, and seven Bates ECSs were turned in due to heels separating completely from the shoes. However, the recruits indicated that eight pairs of each ECSs experienced this problem. It is assumed from feedback received from the recruits, that after the initial turn-in and replace-time frame, individuals held onto their ECSs despite the damage rather than return to the standard Chukka shoe. This means that many individuals continued to wear ECSs with separating heels, and a couple of individuals wore ECSs without heels rather than turn in the shoes.

h. Acceptability

Test participants were asked to rate the appearance of the ECS candidates. Both ECSs were rated positively for appearance on a five-point scale (1=really dislike, 3=fair, and 5=really like). The "overall rating" of the Bates shoe was significantly higher than that of the CT shoe for

the second survey, 4.1 and 3.7 ($t=4.14$, $df=216$, $p<.001$), yet equal to the CT shoe in surveys #1 and #3. The CT ECS received its highest ratings for this criterion in the first survey, and then its ratings decreased slightly in surveys #2 and #3.

In order to get a measure of the acceptability of the ECSs, participants were asked if they would continue to wear the ECSs once they left the RTC. Eighty-four percent ($N=183$) of the total group do plan to wear the ECSs after leaving the RTC. Both the Bates shoe and the CT shoe responses were equal for this inquiry.

In order to determine the features of the ECSs that were most favorable to respondents, recruits were asked to list the features of the ECSs that they liked and disliked. When these features were tallied for each of the boots there were some interesting differences. The CT shoe received more responses on specific features, while the Bates shoe received more responses indicating an overall preference for the total shoe. Tables 10 and 11 list the features of each shoe most commonly liked and disliked, respectively.

Table 10: Most Commonly LIKED Features of the ECS:

	Bates	CT
Roll cuff	31	46
Tongue	11	21
Sole	10	14
Ankle support	9	7
Leather	5	4
Entire shoe	24	6

Table 11: Most Commonly DISLIKED Features of the ECS:

	Bates	CT
Sole	6	17
Tongue	4	10
Roll cuff	4	1
Heel	5	6
Lack of cushioning	3	4

Discussion

The RTC provided a structured environment for testing the candidate shoes. The four divisions which tested the Bates and the Craddock-Terry shoes were comprised of recruits undergoing the same training. The RTC training environment allowed the candidate shoes to be evaluated by individuals based on equal wear time, usage, and training procedures.

Overall, both the Bates and the CT ECSs performed well and were received favorably by recruits at the RTC. The data analyses demonstrated no gender differences in the results received for all factors of this evaluation. Males and females were equal in their ratings of all test criteria.

For all fit and acceptability criteria, with the exception of arch support, the ECSs were rated positively by the recruits as well as medical personnel. The arch support offered by both ECSs was rated as "fair". Comparatively, the CT shoe was more difficult to don and doff compared to the Bates shoe as a result of the narrower instep. Because of the increased difficulty with these tasks, CT wearers often unlaced their shoes to get them on and off. All other ratings on fit criteria, including the ankle support, break-in time, and insert usage, were equal for both shoes. Interestingly, the Bates wearers purchased commercial inserts early in the evaluation than did the CT wearers. However, by the third survey period, the CT group was equal in its usage of inserts. Traction problems and the reports of damage were also equal for both candidates.

Results of performance criteria demonstrated that the ability of wearers to walk, stand, and march in the candidate shoes were positive across all three surveys. The ratings received for running tended to be lower than the other performance criteria for both shoes, with results falling in the "fair" category. Only one significant difference was detected between the candidate shoes on the performance criteria. The Bates shoe was rated significantly better for standing than was the CT. These ratings could have been affected by the widespread use of inserts by the Bates group early in the evaluation.

Ventilation of the ECSs to alleviate sweat was a common comfort issue for both ECS candidates. Over 40% of both groups experienced consistent sweating and wetness of feet. This is most likely a trade-off between this type of footwear, which is constructed to provide safety and durability, and mild user discomfort caused by sweating.

A major consideration of this evaluation was to measure the incidences of foot problems for both ECSs. The reported problems received by the recruits decreased over time between the first, second, and third surveys. Both candidates were deemed acceptable by users, and good candidates for the replacement of the standard Chukka shoe.

Overall, there were few differences between the two candidates, and those that occurred were minor. In fact, medical personnel from the RTC reported that the candidate shoes were superior to the current Chukka shoe worn by recruits. Medical personnel also reported no increase in the incidence of foot problems with the shoes when compared to the standard Chukka shoe.

Recruit Division Commanders' Study

Methodology

Subjects

A total of 72 (49 Male, 23 Female) RDCs participated in this study. However, surveys were returned by only 57 (39 Male, 18 Females). Of the returned surveys, 40 subjects had completed a preference survey for both pairs of shoes (26 Male, 14 Female). Since this evaluation was designed to compare the two shoe types, only the data from the 40 subjects who completed a questionnaire for both pairs of shoes were retained for analysis.

Design and Procedures

To obtain a direct comparison of the ECSs, with a limited number of subjects, each participant was issued a pair of Bates shoes, and a pair of CT shoes. The test period lasted six weeks, with each shoe being worn for a continuous three-week period. This allowed sufficient time for break-in, and user accommodation to shoe characteristics. The possible effect of shoe order on preference was controlled by randomly assigning either Bates or CT shoes to be worn first. Thus, approximately 50% wore Bates shoes and 50% wore CT shoes in the initial three weeks. Users then wore their second pair of shoes for the remaining three weeks. The ECSs were worn in place of the subject's regular military shoe.

Preference questionnaires were completed after each three-week wear period. A total of two preference surveys were completed by each subject, one for each type of shoe. Direct comparison data of the shoes were further obtained by a comparison questionnaire, administered at the end of the six-week wear period. This questionnaire addressed all six areas of investigation, and asked users to select their preferred shoe. A copy of the comparison survey can be found in Appendix D.

Results

a. Data Analysis

Data from the preference questionnaires were summarized, and means and standard deviations were calculated. Open-ended questions were analyzed and common responses tallied. Frequencies of responses to the RDC comparison survey were computed. The data were analyzed using two standard statistical procedures. The Pearson Chi Squared (χ^2) statistic was applied to dichotomous data, while a two factor, split-plot Analysis of Variance (ANOVA) was used in the analysis of scale and continuous data. Shoe type (Bates vs CT) served as the with-in subject factor, and gender was a between-subject factor. Results were deemed significant when the confidence level was equal to or greater than 95% ($P \leq 0.05$).

b. Demographics

In order to fairly compare the Bates and CT shoes, it was important to have subjects whose shoes fit correctly. Using the overall fit rating in the preference questionnaire, those subjects who rated the overall fit of both the Bates and CT ECSs as "just right" were identified. Only their data were included in the analysis. Of the original 40 subjects considered for the analysis 73% were fit well for both ECSs (22 Male, 7 Female). Table 12, shows the overall fit ratings by shoe type and gender. (Note: "Bad" fit ratings are not necessarily from the same subjects)

Table 12: Ratings of Overall Fit

	Bates		CT	
	M	F	M	F
Good	24	11	24	10
Poor	2	2	2	2

(Good="Just Right" Poor="Too Loose" OR "Too Tight")

c. Fit Assessment

Table 13 shows the reported frequency with which test participants wore the shoes. Approximately half the subjects wore both shoes every day. The approximate average wear time for shoes was between 7 and 9 hours, and was the same for males and females, and shoe type. Inserts were rarely utilized, with only four participants reporting the use of them.

Table 13: Wear Pattern

	Bates		CT	
	M	F	M	F
Wear Every Day	11	3	9	3
Do Not Wear Every Day	11	4	13	3

Eight factors were used to assess the fit of the shoes: ease of donning, ease of doffing, fit of ankle, fit of toes, fit of heel, fit of instep, arch support, and ankle support. All fit factors were rated positively, and the split-plot ANOVA revealed no significant differences in ratings between the ECSs or by gender.

d. Ability to Perform Activities

Wearers' ability to perform various activities was measured by ratings of: ability to stand, walk, run, and march. Table 14 shows the mean rating for each measure. All ratings were better than "fair", with the vast majority of measures receiving a rating of close to "good". An ANOVA revealed no significant differences between mean responses for either shoe regardless of gender.

Table 14: Mean Ratings of Factors Assessing Wearers' Ability to Function

	Bates		CT	
	M	F	M	F
Ability to Stand	2.91	2.86	2.91	3.00
Ability to Walk	2.82	2.71	2.77	2.57
Ability to Run	2.57	2.33	2.50	3.00
Ability to March	2.79	2.33	2.64	2.67

1.00=Poor, 2.00=Fair, 3.00=Good

Shoe performance was further characterized by rating each shoe's traction on a number of surfaces. Table 15 presents the mean ratings for traction on a number of different surfaces.

Table 15: Traction Ratings for Different Surfaces

	Bates		CT	
	M	F	M	F
Wet/Moist	2.90	2.93	2.95	3.00
Oil Covered	3.00	2.67	3.00	3.00
Waxed	2.81	2.83	2.95	3.00
Nonskid	2.92	2.83	3.00	3.00
Painted	2.89	2.80	3.00	3.00
Grass	3.00	2.80	2.88	3.00
Mud	2.93	2.75	2.86	3.00
Pavement	2.95	2.86	3.00	3.00
Carpet	3.00	2.86	3.00	3.00
Wooden Surface Floors	3.00	2.75	2.93	3.00

1.00=Poor, 2.00=Fair, 3.00=Good

Both the Bates and CT shoes provide good traction on all surfaces. All surfaces rated received a mean traction rating close to "good". No significant differences were found between the mean traction ratings for either shoe on any surface. This held true for males and females.

e. Comfort

Comfort was measured in three different ways: break-in period, ability of shoes to keep feet dry, and thermal comfort. The reported break-in times for both ECSs were very short, with mean break-in times from 2.24 to 4.83 days. An ANOVA revealed no significant differences between ECSs, regardless of gender.

Both shoes were found to keep wearers' feet dry. Approximately 30% of Bates and CT shoes became wet. All subjects whose shoes became wet, found that the ECSs adequately kept their feet dry.

The mean thermal comfort rating of the Bates and CT shoes was close to “just right” for each shoe (Bates & CT 1.86, scale: 1=Too Warm, 2= Just Right, 3=Too Cold). An ANOVA found no significant differences between the ratings of either shoe regardless of gender. Although the mean rating is close to “just right”, some test participants found that both shoes had a tendency to retain moisture and did not “breathe”. Thirty-one percent of Bates wearers and 27% of CT wearers said that their feet had perspired and remained wet.

f. Medical Problems

The number of shoe wearers reporting medical problems is displayed in Table 16, along with the tally of each medical problem reported. In detailing the type of medical problem experienced, each subject was able to check all problems that occurred.

Table 16: Medical Problems Experienced

	Bates	CT
Medical Problems	31% (n=9)	21% (n=6)
Blisters	-	1
Foot Cramps	-	1
Aching Legs	-	-
Callouses	-	-
Aching Feet	5	3
Aching Back	-	-
Other	4	1

Note: Other includes: Tender/Aching Toes, Sore/Rubbed Ankle, Tender Heels, and Unspecified problems.

Although a number of medical problems were reported, none of these required medical attention and most problems reportedly went away after the break-in period.

g. Durability

No durability problems were identified during the RDC study. Even when subjects whose shoes did not fit well were included in the analysis; no problems were identified.

h. Acceptability

Acceptability of the ECSs was measured in a number of ways. Ratings were obtained for style, and overall satisfaction and performance. Test participants were also asked if they would purchase the ECS themselves. In addition, open-ended questions asked users to list their most and least favored features.

The style and overall ratings are presented in Table 17.

Table 17: Mean Style and Overall Ratings

	Bates		CT	
	M	F	M	F
Style	4.23	4.43	4.33	3.71
Scale: (1=Really Dislike, 3=Fair, 5=Really Like)				
Overall Rating	4.14	4.42	4.22	3.42
Scale: (1=Very Poor, 3=Fair, 5=Excellent)				

Both shoes were rated similarly for style, with ratings close to "like". An ANOVA found no significant differences between the shoe styles regardless of gender. The overall ratings were all slightly better than "good", except for the female rating of the CT shoe, which was close to "fair". The lower overall female rating of the CT shoe is significantly different than that of the Bates ($F=4.59$, $df=1,27$, $p=0.041$).

Table 18 shows the number of test participants who would or would not buy the ECSs which they had worn.

Table 18: Purchase of Enhanced Chukka Shoes

	Bates		CT	
	M	F	M	F
Would Purchase	21	7	21	4
Would Not Purchase	1	0	1	3

The purchase response of the females for the CT shoe was significantly different from the responses of the males for the CT shoe and the responses for the Bates shoe ($\chi^2=6.55$, $df=1$, $p=0.01$). This was consistent with the pattern in the overall mean ratings for shoes.

Table 19 shows that the roll cuff on the ankle support is the most liked feature for the Bates shoe (n=9) and second most liked for the CT shoe (n=5). The most favored feature of the CT shoe is the padded tongue (n=11).

In contrast, Table 20 shows that the most disliked feature of the Bates shoe was the unpadded tongue. All other disliked features for both shoes were only reported once.

Table 19: Most LIKED Features

	Bates	CT
Roll Cuff/Ankle Cushion	9	5
Ankle Support	2	-
Tongue	1	11
Sole	1	-
Inserts	2	-
Leather	-	1
Heel	1	-
Arch fit	1	1

Table 20: Most DISLIKED Features

	Bates	CT
Tongue	6	-
Sole/Hard	1	1
Laces/Lace Holes	-	1
Steel Toe	1	1
Roll Cuff	-	1
Weight	1	1
Insole	1	-
Heel	-	1
Need Cushioning	-	1

i. RDC Comparison Survey

The responses from the comparison survey were tallied. The percentages of subject responses for each question are displayed in Table 21. Wearers were asked to choose which shoe they preferred for a number of parameters: fit, ability to function, comfort, and shoe performance. A large proportion of respondents selected both shoes as equal in most categories. When subjects expressed a preference for one shoe over the other the Bates shoes received more favorable responses than the CT shoes for all factors except users' ability to run, for which the CT shoe received more favorable responses.

Table 21: Comparison of Shoes for Various Characteristics

	Bates (%)	CT (%)	Same (%)
Overall Shoe Preference	42.1	36.8	21.1
Fit	44.7	28.9	26.3
Comfort	42.1	36.8	21.1
Durability	18.4	13.2	68.4
Traction	21.1	13.2	65.8
Thermal Comfort	31.6	21.1	47.4
Water Repellency	21.1	15.8	63.2
Standing	34.2	26.3	39.5
Walking	44.7	34.2	21.1
Running	31.4	34.3	34.3
Marching	40.0	31.4	28.6
Comfort of Ankle	36.8	26.3	36.8
Comfort of Toes	34.2	31.6	34.2
Comfort of Heel	31.6	28.9	39.5
Comfort of Instep	47.4	21.1	31.6
Fit of Ankle	31.6	28.9	39.5
Fit of Toes	39.5	28.9	31.6
Fit of Heel	34.2	26.3	39.5
Fit of Instep	39.5	26.3	34.2
Easier to Break In	39.5	15.8	44.7
Easier to Put On	37.8	10.8	51.4
Easier to Take Off	35.1	8.1	56.8

(Percentages may not add up to 100% due to rounding)

Discussion

The RDC wear test was aimed at identifying any major problems experienced with the Bates and CT shoes. This was done by subjecting them to direct comparison in a training setting. The results of the preference survey indicated that both shoes were acceptable to the user. Both shoes were rated positively for fit, users' ability to run, walk, march and walk, traction over different surfaces, appearance, and overall rating. Break-in times were short, between two and five days and the thermal comfort of the shoes was found to be "just right" and kept the wearers' feet dry.

Although, both ECSs in a number of cases caused minimal medical problems, such as blisters, these problems were not found to be lasting, generally being cleared up after the shoes were broken-in. No subject needed professional medical treatment for these ailments.

The only area in which comfort was affected in a negative way was in the breathability of the shoes. Thirty-one percent of Bates and 27% of CT wearers said their feet had perspired and remained wet.

In the preference survey (performance and user acceptability), there were no differences found between the Bates and CT shoes. On almost all factors of comparison no statistical differences were found. With respect to acceptability, the female overall rating of the CT shoe was significantly lower than that of the Bates. This is a difference of "fair" to "good". This finding was further confirmed by the response of almost 50% of the females who stated that they would not buy the CT shoe, but did state that they would buy the Bates shoe. It should be borne in mind that this was the response of only three female subjects. While these differences are real, the "fair" rating of the CT shoe is not negative. One of the respondents said that if given the choice between the current Chukka shoe and the CT shoe, she would purchase the CT shoe. These two results may indicate a slight preference for the Bates shoe in a female population. In comparing the most liked and most disliked aspects of both shoes one characteristic stands clear. The padded tongue of the CT shoe is the most liked feature, while the unpadded tongue of the Bates shoe is the most disliked feature. This result makes the suggestion that a padded tongue should be adopted by all ECS manufacturers.

The comparison survey found that the Bates shoe was favored more than the CT shoe on all characteristics except one. The mean female ratings and purchase responses indicated a slight preference for the Bates shoe, but no other trend in the preference data was found.

In conclusion, this study found that the Bates and CT shoes are good replacements for the present Chukka shoe. Both shoes were rated positively and were found to be acceptable by the test participants.

Shipboard Study

Methodology

Subjects

One hundred and twenty-four subjects were issued shoes (74 Males, 50 Females). Table 22 lists the shoes issued to each ship.

Table 22: Shoes Issued by Ship

	Bates		CT	
	Male	Female	Male	Female
Deyo	10	-	15	-
Shenandoah	-	-	25	26
Gunston Hall	23	22	1	2

Of the 124 original test participants, 95 (58 Male, 37 Female) returned completed questionnaires. Of these, 44 surveys were for the Bates shoe (28 Male, 16 Female) and 51 for the CT shoe (30 Male, 21 Female).

Design and Procedures

The purpose of the shipboard wear test was to identify any major problems with ECSs in an operational setting. Toward this end, a between-subjects design was adopted and each subject received one pair of shoes, either a pair of Bates or CT. Shoes were issued to subjects onboard three ships: the USS Deyo, USS Shenandoah, and USS Gunston Hall. Subjects onboard the USS Shenandoah received only CT shoes; USS Gunston Hall test participants received primarily Bates shoes (Approximately 94%, see table 22), while the USS Deyo participants received approximately 50% Bates and 50% CT shoes.

Shoes were worn for a total of five weeks in place of their regular military shoe, providing sufficient time for break-in and wearer accommodation to shoe characteristics. Shipboard preference questionnaires were completed at the end of the five weeks in the presence of NCTRF personnel.

Results

a. Data Analysis

Data from the preference questionnaires were summarized, and means and standard deviations were calculated. Open-ended questions were analyzed, and common responses were tallied. The data were analyzed using two standard statistical procedures. The Pearson Chi Squared (χ^2) statistic, was applied to dichotomous data, while a two-way Analysis of Variance (ANOVA) with shoe type (Bates vs CT) and Gender (Male vs Female) serving as between-subject factors, was used in the analysis of scale and continuous data. Results were deemed significant when the confidence level was equal to or greater than 95% ($P \leq 0.05$).

b. Demographics

In order to fairly compare the Bates and CT shoes, it was important to have subjects whose shoes fit correctly. Using the overall fit rating in the preference questionnaire, those subjects who rated the overall fit of their issued shoe as "just right" were identified. Only their data were included in the analysis. Of the original 95 subjects considered for the analysis approximately 78% were fit well (A total of 74). Table 23 shows the overall fit ratings by shoe type and gender.

Table 23: Ratings of Overall Fit

	Bates		CT	
	M	F	M	F
Good	24	8	25	17
Bad	4	8	5	3*

(Good="Just Right" Bad="Too Loose" OR "Too Tight")

* 1 Subject did not rate overall fit

The fit rate for male test participants is consistent for each ECS. The female fit rate however, for the Bates shoe is significantly different from that of the males ($\chi^2=5.13$, $n=16$, $df=1$, $p=0.023$), with 50% of the female subjects reporting a “bad” fit. Of the women who were found to have a “bad” fit, 50% ($n=4$) stated that the shoe was “too loose” and 50% stated that the shoe was “too tight”. This suggests a problem in the initial fitting of the shoes, rather than any problem with the shoe itself.

c. Fit Assessment

Table 24, shows the reported frequency with which test participants wore the shoes. Approximately three-quarters of the subjects wore the ECSs every day. The wear pattern is consistent between the Bates and CT shoes for both male and female. The median average wear time for both shoes was listed as being 7 to 9 hours. Inserts were rarely utilized, with only three participants using them.

Table 24: Wear Pattern

	Bates		CT	
	M	F	M	F
Wear Every Day	19	7	18	13
Do Not Wear Every Day	5	1	7	4

Eight factors were used to assess the fit of the shoe: ease of donning, ease of doffing, fit of ankle, fit of toes, fit of heel, fit of instep, arch support, and ankle support. All fit factors were rated positively. However, a two-way ANOVA revealed that mean responses for two factors, fit of the ankle and fit of the heel were rated differently.

The fit of the ankle was found to be significantly different ($F=5.05$, $df=1,68$, $p=0.02$) between the ratings of males and females for both shoes. Both the Bates and CT shoes were rated slightly “too tight” by the females ($\bar{x}=1.75$, 1.88 , respectively) while the males rate the fit as “just right” ($\bar{x}=2.00$, 2.00 , respectively).

The ratings for the fit of the heel were found to be significantly different between the Bates and CT shoes ($F=9.273$, $df=1,68$ $p=0.003$; $\bar{x}=2.13$, 2.00 , respectively) and between the responses of males and females ($F=5.619$, $df=1,68$ $p=0.021$; $\bar{x}=2.02$, 2.12 , respectively).

d. Ability to Perform Activities

Wearers’ ability to perform various activities was measured by ratings of ability to stand, walk, run, march, descend ladders, and ascend ladders. Table 25, shows the mean rating for each factor. An ANOVA revealed no significant differences between mean responses for either shoe, regardless of gender.

Table 25: Mean Ratings of Factors Assessing Wearers’ Ability to Function

	Bates		CT	
	M	F	M	F
Ability to Stand	2.88	2.88	2.88	2.71
Ability to Walk	2.96	3.00	2.96	2.88
Ability to Run	2.38	2.75	2.68	2.63
Ability to March	2.75	3.00	2.91	2.86
Descend Ladders	2.75	2.88	2.84	2.82
Ascend Ladders	2.75	2.88	2.88	2.82

1.00=Poor, 2.00=Fair, 3.00=Good

Shoe performance was further characterized by rating each shoe’s traction on a number of surfaces. Table 26 presents the mean ratings for traction.

Table 26: Traction Ratings for Different Surfaces

	Bates		CT	
	M	F	M	F
Wet/Moist	2.68	2.75	2.92	2.88
Oil Covered	2.39	2.50	2.44	2.83
Waxed	2.86	2.71	2.91	3.00
Nonskid	2.96	2.88	3.00	3.00
Painted	2.86	2.83	2.88	3.00
Carpet	3.00	2.88	2.95	3.00
Steel Ladder Treads	2.88	2.75	2.84	3.00
Smooth Steel Decks	2.77	2.75	2.79	3.00

1.00=Poor, 2.00=Fair, 3.00=Good

Both the Bates and CT shoes were found to provide generally good traction on all surfaces. No significant differences were found among any rating.

e. Comfort

Comfort was measured by three factors: break-in period, ability of shoes to keep feet dry, and thermal comfort. The break-in times for both Bates and CT shoes are quite short with mean break-in times, between shoe type and gender, varying from 2.70 to 3.88 days. No significant differences were found among the ratings.

Both shoes were found to keep wearers' feet dry most of the time. Approximately 53% of the ECSs became wet during their wear time. Of the subjects whose shoes got wet, 85% found that the Bates and CT shoes adequately kept their feet dry. The remaining 15% stated that their feet became wet.

The mean thermal comfort rating of the Bates and CT shoes was close to “just right” for each shoe (\bar{x} =1.91, 1.86 respectively; scale: 1=Too Warm, 2= Just Right, 3=Too Cold). A two-way ANOVA found no significant differences between the ratings of either shoe or between male and female subjects. Although the mean rating was close to “just right”, test participants from the Bates and CT groups found that the ECSs did not breathe, and retained moisture. Nineteen percent of Bates and 28% of CT wearers said that their feet had perspired and remained wet.

f. Medical Problems

The percentage of test participants experiencing medical problems is displayed in Table 27, along with the tally of the medical problems reported. In detailing the type of medical problem experienced, each subject was able to check all problems that occurred. Thus, in some instances, subjects reported more than one medical problem.

Table 27: Medical Problems Experienced

	Bates (N=32)	CT (N=42)
Medical Problems	22% (n=7)	26% (n=11)
Blisters	2	6
Foot Cramps	-	1
Aching Legs	-	1
Callouses	3	3
Aching Feet	1	3
Aching Back	1	2
Other	2	1

Note: Other includes: Tender/Aching Toes, Sore/Rubbed Ankle, Tender Heels, and Unspecified problems.

The frequency of medical problems was similar for both ECSs. Although a number of medical problems were reported, none of these required medical attention, and most problems reportedly went away after the break-in period.

g. Durability

The frequency of sustaining some form of damage by ECSs is shown in Table 28.

Table 28: Frequency of Damage to Shoes

	Bates		CT	
	M	F	M	F
Damaged	8	4	6	6
Not Damaged	20	12	23	15

Approximately 27% of Bates shoes and 24% of CT shoes were damaged in some way. Table 29, summarizes the problems and frequency of occurrence for each shoe.

Table 29: Summary of Damage to Shoes

	Bates	CT
Heel Starting to Separate	2	4
Sole Starting to Separate	-	2
Rip/Cut/Scuffed Leather	10	6

h. Acceptability

Acceptability of the ECSs was measured by a number of factors; the style of the shoes, an overall rating, and willingness to purchase the ECS. In addition, open-ended questions asked for users to list their most favored and least favored features.

The mean style and overall ratings are presented in Table 30.

Table 30: Mean Style and Overall Ratings

	Bates		CT	
	M	F	M	F
Style	4.33	4.00	4.33	4.41
Scale: (1=Really Dislike, 3=Fair, 5=Really Like)				
Overall Rating	4.23	4.13	4.40	4.24
Scale: (1=Very Poor, 3=Fair, 5=Excellent)				

The mean ratings for the ECSs were rated similarly on both the style scale, and on the overall rating, with all ratings above "good". A two-way ANOVA found no significant differences.

Table 31 shows the number of test participants who would or would not buy the ECS which they had worn.

Table 31: Purchase of Enhanced Chukka Shoes

	Bates		CT	
	M	F	M	F
Would Purchase	17	8	18	15
Would Not Purchase	5	0	7	2

Over 78% of respondents stated that they would buy one or other of the shoes if given the opportunity. Most of those who did not want to buy them reported they had already found a shoe/boot which they preferred.

Tables 32 and 33 list the tallied open-end responses for the most liked and most disliked features of the shoes. Please note that subjects could report as many features as they liked.

Table 32: Most Commonly LIKED Features

	Bates	CT
Roll Cuff/Ankle Cushion	8	11
Ankle Support	2	3
All	2	4
Tongue	2	4
Sole	1	2
Weight	1	1
Inserts	1	1
Leather	-	1
Arch fit	-	1

Table 33: Most Commonly DISLIKED Features

	Bates	CT
Tongue	3	3
Sole/Hard	1	3
Laces/Lace Holes	1	3
Steel Toe	-	2
Not High Enough	-	1
Roll Cuff	-	1

Discussion

The shipboard wear test aimed to identify any major problems and user acceptance of both the Bates and CT shoes in an operational setting. The results of the preference survey indicated that neither shoe had a negative impact on the user. Both shoes were rated positively in the areas of fit, users' ability to run, walk, march and walk, traction over different surfaces, looks, and overall ratings. Break-in times were short, between two and four days. The thermal comfort of the shoes were found to be "just right", and on the whole, kept the wearers' feet dry.

While both ECSs caused minor medical problems, such as blisters, these problems were not found to be lasting since they generally cleared up after the shoes were broken in. Also, no subjects needed professional medical treatment for these ailments.

With respect to comfort, the only problem experienced was in the breathability of the shoes. Nineteen percent of Bates and 28% of CT wearers said that their feet had perspired and remained wet.

In general, there were very few differences between the Bates and CT shoes. On almost all points of comparison the shoes were identical. In fact, the only question where a statistical difference occurred between the shoes was for the fit of the heel with mean ratings for the Bates and CT of 2.13 and 2.00, respectively. This statistically significant result should be put in perspective. The rating scale for both questions was: 1=Too Tight, 2=Just Right, 3=Too Loose. Therefore the differences between the ratings are minimal, at best, and do not necessarily imply there was a real fit problem.

There were very slight differences in the responses of males and females to the two shoes. The only statistical differences were for the fit of the ankle and the fit of the heel. In the case of the fit of the ankle, the mean female rating was slightly tighter than that of the males; whereas for the fit of the heel, the mean female rating was slightly looser. Again, the differences between the mean rating scores were so small that they have very little practical meaning.

One factor that could be further investigated is the durability of the shoes. The Bates and the CT shoes both showed some durability problems while in use onboard ship, especially in the area of the heel separating from the sole. Although the number of incidences of this problem is fairly small, it is unclear why these problems occurred.

The results of the shipboard study indicated that the Bates and CT shoes are good replacements for the present Chukka shoe. Both shoes were rated positively or found to be acceptable for all of the six areas of the investigation for operational use.

Conclusions

Overall, there were few differences between the two candidates, and those that occurred were minor. Both the Bates and the Craddock-Terry candidates were received favorably by the three test groups. Individually, both the Bates and the Craddock-Terry ECSs performed well and received positive ratings on the major test factors, such as the fit of the shoe, comfort, durability, acceptability, and users' ability to perform activities while wearing the ECSs. All other ratings on fit criteria, including the ankle support, break-in time, and insert usage, were rated positively by all groups.

When comparing the test groups, the findings were consistently equal, with the exception of the RTC group. The RTC group varied from the other two groups on two ratings: arch support, and the ability to don and doff the ECSs. The RTC group rated the arch support as "fair", compared to the RDC and shipboard groups more positive ratings of the ECSs on this criterion. The RTC group also rated the Craddock-Terry shoe as more difficult to don and doff compared to the Bates shoe. The RDC and the shipboard groups did not report these difficulties donning and doffing the Craddock-Terry. However, the RTC group alleviated this problem by fully unlacing their shoes to get them on and off.

Ventilation of the ECSs to alleviate sweat was a common comfort issue for both ECS candidates. Approximately 30% of the RDC and shipboard participants, and 40% of the RTC group experienced consistent sweating and wetness of feet. This is most likely a trade-off with this type of footwear, which must provide safety and durability with a thick leather construction, and also prevent user discomfort from sweating.

A major point of interest in this evaluation was to measure the incidences of foot problems for both ECSs. Both candidates were deemed acceptable by users, and good candidates for the replacement of the standard Chukka shoe. The reported problems received by the test participants were minor and decreased during the test period. In fact, medical personnel from the RTC reported that the incidence of problems was lower than the number normally received for the standard Chukka shoe.

A durability issue arose during the evaluation which is currently being addressed by the Bates and Craddock-Terry manufacturers. Both candidate shoes had problems with the heel separating from the shoe. In some instances the heel separated completely, and in most cases only partially.

The manufacturers are currently modifying the heel attachment method to correct this problem in the future.

In conclusion, this study determined that the Bates and Craddock-Terry candidates are equal performers in all operational settings, both land and shipboard. Both ECSs received positive ratings from test participants and are good candidates for replacing the standard Chukka shoe.

Appendix A

Recruit Enhanced Chukka Shoe Survey

Enhanced Chukka Shoe Survey

Date _____

Questionnaire Number _____

1. Last Four _-_-_-

B

C

2. ☐ Male ☐ Female

3. Date Of Birth _____

4. A. Rate the ease of putting on the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

Please explain any problems:

B. Rate the ease of taking off the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

Please explain any problems:

C. Rate the fit of the Enhanced Chukka Shoes in the following specific areas:

Ankle: ☐ Too Tight ☐ Just Right ☐ Too Loose

Toes: ☐ Too Tight ☐ Just Right ☐ Too Loose

Heel: ☐ Too Tight ☐ Just Right ☐ Too Loose

Instep(top of foot): ☐ Too Tight ☐ Just Right ☐ Too Loose

D. Rate the overall fit of the Enhanced Chukka Shoes:

☐ Too Tight ☐ Just Right ☐ Too Loose

5. A. Do you wear the Enhanced Chukka Shoe every day?
☐ Yes ☐ No

If **NO**, how many days have you worn them? _____

- B. Approximately how many hours per day have you been wearing the Enhanced Chukka shoes?
☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10+

- C. What other footwear have you worn during this evaluation?
Please list below:

6. A. If you wear more than one pair of black issue socks with the Enhanced Chukka Shoes, how many pairs of each type do you wear?
☐ White athletic socks number of pairs _____
☐ Black issue socks number of pairs _____

- B. Why?

7. Did you wear additional inserts or cushioning in your Enhanced Chukka shoes? ☐ Yes ☐ No

If **YES**, explain:

8. A. Rate the Enhanced Chukka Shoe's arch support.
☐ Poor ☐ Fair ☐ Good

- B. If **Poor** or **Fair**, please explain:

9. A. Rate the Enhanced Chukka Shoe's ankle support.
☐ Poor ☐ Fair ☐ Good

B. If *Poor* or *Fair*, please explain:

10. Rate your ability to perform the following activities while wearing the Enhanced Chukka Shoe:

Stand.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Walk.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Run.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
March.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

11. Rate the Enhanced Chukka Shoe's traction on the following surfaces:

Wet/Moist.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Oil Covered (POL).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Waxed (tile deck).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Non-skid	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Painted	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Grass	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Mud	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Pavement	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Carpet	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Wooden surface floors	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

12. A. Did your Enhanced Chukka Shoes get wet?
☐ Yes ☐ No

***** IF NO, PROCEED TO QUESTION 13 *****

If YES:

- B. Did your Enhanced Chukka Shoes keep your feet dry?
☐ Yes ☐ No

- C. Approximately how long did it take them to dry completely?
☐ 1-3 Hours ☐ 4-6 Hours ☐ 7-9 Hours ☐ 10+Hours
- D. How did you dry them (air-dry naturally, etc.)?
Please explain:

13. Rate the thermal comfort (feet too warm or not warm enough) of the Enhanced Chukka Shoe.
☐ Too Warm ☐ Just Right ☐ Too Cold

If *Too Warm*, are they too warm:

- ☐ All of the time ☐ Some of the time
Explain:

If *Too Cold*, are they too cold:

- ☐ All of the time ☐ Some of the time
Explain:

14. Does the Enhanced Chukka Shoe cause your feet to sweat and stay wet?
☐ Yes ☐ No

15. A. Did the Enhanced Chukka Shoe cause any of the following problems (mark all that apply):
☐ None ☐ Blisters ☐ Foot Cramps ☐ Aching Legs
☐ Callouses ☐ Aching Feet ☐ Aching Back ☐ Other _____

B. Did the problem continue? Please explain.

- C. Did it require medical attention?
☐ Yes ☐ No

If YES, explain.

16. How many times did you have to wear the Enhanced Chukka Shoe to break it in?

- ☐ Number of times _____
- ☐ Did not need to be broken-in
- ☐ Cannot be broken-in

17. Did your Enhanced Chukka Shoes get damaged (rips, tears, seams separate, etc.) during the evaluation? ☐ Yes ☐ No

If **YES**, please indicate where on the picture below, and describe the problem.



18. Please rate the look of the Enhanced Chukka Shoe?

☐ 1
*Really
Dislike*

☐ 2

☐ 3
Fair

☐ 4

☐ 5
*Really
Like*

19. List any design features (example: sole, tongue, roll cuff) that you really like.
20. List any design features (example: sole, tongue, roll cuff) that you really dislike.
21. Please give an overall rating of the Enhanced Chukka Shoe.
- | | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 2 | <input type="radio"/> 3 | <input type="radio"/> 4 | <input type="radio"/> 5 |
| <i>Very
Poor</i> | | <i>Fair</i> | | <i>Excellent</i> |
22. If given a choice, would you continue to wear the Enhanced Chukka Shoe after leaving the RTC? ☐ Yes ☐ No
- If **NO**, please explain:
23. Do you have additional comments/recommendations on the Enhanced Chukka Shoe?

Appendix B

RDC Preference Survey

Enhanced Chukka Shoe Survey

Date _____

Questionnaire Number _____

1. Last Four _-_-_-

B

C

2. ☐ Male ☐ Female

3. Date Of Birth _____

4. A. Rate the ease of putting on the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

Please explain any problems:

B. Rate the ease of taking off the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

Please explain any problems:

C. Rate the fit of the Enhanced Chukka Shoes in the following specific areas:

Ankle: ☐ Too Tight ☐ Just Right ☐ Too Loose

Toes: ☐ Too Tight ☐ Just Right ☐ Too Loose

Heel: ☐ Too Tight ☐ Just Right ☐ Too Loose

Instep(top of foot): ☐ Too Tight ☐ Just Right ☐ Too Loose

D. Rate the overall fit of the Enhanced Chukka Shoes:

☐ Too Tight ☐ Just Right ☐ Too Loose

5. A. Do you wear the Enhanced Chukka Shoe every day?
☐ Yes ☐ No

If *NO*, how many days have you worn them? _____

- B. Approximately how many hours per day have you been wearing the Enhanced Chukka shoes?
☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10+

- C. What other footwear have you worn during this evaluation?
Please list below:

6. A. If you wear more than one pair of black issue socks with the Enhanced Chukka Shoes, how many pairs of each type do you wear?
☐ White athletic socks number of pairs _____
☐ Black issue socks number of pairs _____

- B. Why?

7. Did you wear additional inserts or cushioning in your Enhanced Chukka shoes?
☐ Yes ☐ No

If *YES*, explain:

8. A. Rate the Enhanced Chukka Shoe's arch support.
☐ Poor ☐ Fair ☐ Good

- B. If *Poor* or *Fair*, please explain:

9. A. Rate the Enhanced Chukka Shoe's ankle support.
☐ Poor ☐ Fair ☐ Good

B. If *Poor* or *Fair*, please explain:

10. Rate your ability to perform the following activities while wearing the Enhanced Chukka Shoe:

Stand.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Walk.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Run.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
March.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

11. Rate the Enhanced Chukka Shoe's traction on the following surfaces:

Wet/Moist.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Oil Covered (POL).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Waxed (tile deck).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Non-skid	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Painted	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Grass	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Mud	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Pavement	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Carpet	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Wooden surface floors	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

12. A. Did your Enhanced Chukka Shoes get wet?
☐ Yes ☐ No

***** IF NO, PROCEED TO QUESTION 13 *****

If YES:

- B. Did your Enhanced Chukka Shoes keep your feet dry?
☐ Yes ☐ No

C. Approximately how long did it take them to dry completely?
☐ 1-3 Hours ☐ 4-6 Hours ☐ 7-9 Hours ☐ 10+Hours

D. How did you dry them (air-dry naturally, etc.)?
Please explain:

13. Rate the thermal comfort (feet too warm or not warm enough) of the Enhanced Chukka Shoe.

☐ Too Warm ☐ Just Right ☐ Too Cold

If *Too Warm*, are they too warm:

☐ All of the time ☐ Some of the time

Explain:

If *Too Cold*, are they too cold:

☐ All of the time ☐ Some of the time

Explain:

14. Does the Enhanced Chukka Shoe cause your feet to sweat and stay wet?

☐ Yes ☐ No

15. A. Did the Enhanced Chukka Shoe cause any of the following problems
(mark all that apply):

☐ None ☐ Blisters ☐ Foot Cramps ☐ Aching Legs
☐ Callouses ☐ Aching Feet ☐ Aching Back ☐ Other _____

B. Did the problem continue? Please explain.

C. Did it require medical attention?

☐ Yes ☐ No

If YES, explain.

16. How many times did you have to wear the Enhanced Chukka Shoe to break it in?

- ☐ Number of times _____
- ☐ Did not need to be broken-in
- ☐ Cannot be broken-in

17. Did your Enhanced Chukka Shoes get damaged (rips, tears, seams separate, etc.) during the evaluation? ☐ Yes ☐ No

If **YES**, please indicate where on the picture below, and describe the problem.



18. Please rate the look of the Enhanced Chukka Shoe?

☐ 1
*Really
Dislike*

☐ 2

☐ 3
Fair

☐ 4

☐ 5
*Really
Like*

19. List any design features (example: sole, tongue, roll cuff) that you really like.

20. List any design features (example: sole, tongue, roll cuff) that you really dislike.

21. Please give an overall rating of the Enhanced Chukka Shoe.

☐ 1
*Very
Poor*

☐ 2

☐ 3
Fair

☐ 4

☐ 5
Excellent

22. If given a choice, would you continue to wear the Enhanced Chukka Shoe after leaving the RTC? ☐ Yes ☐ No

If *NO*, please explain:

23. Do you have additional comments/recommendations on the Enhanced Chukka Shoe?

Appendix C

Shipboard Preference Survey

Enhanced Chukka Shoe Survey (SB)

Date _____

Questionnaire Number _____

Ship _____

1. Last Four _-_-_- B C

2. ☐ Male ☐ Female

3. Date Of Birth _____

4. A. Rate the ease of putting on the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

 Please explain any problems:

 B. Rate the ease of taking off the Enhanced Chukka Shoes:

☐ Easy ☐ Fairly Easy ☐ Fairly Difficult ☐ Difficult

 Please explain any problems:

 C. Rate the fit of the Enhanced Chukka Shoes in the following specific areas:

Ankle: ☐ Too Tight ☐ Just Right ☐ Too Loose

Toes: ☐ Too Tight ☐ Just Right ☐ Too Loose

Heel: ☐ Too Tight ☐ Just Right ☐ Too Loose

Instep(top of foot): ☐ Too Tight ☐ Just Right ☐ Too Loose

 D. Rate the overall fit of the Enhanced Chukka Shoes:

☐ Too Tight ☐ Just Right ☐ Too Loose

5. A. Do you wear the Enhanced Chukka Shoe every day?
○ Yes ○ No

If *NO*, how many days have you worn them? _____

- B. Approximately how many hours per day have you been wearing the Enhanced Chukka shoes?
○ 1-3 ○ 4-6 ○ 7-9 ○ 10+

- C. What other footwear have you worn during this evaluation?
Please list below:

6. A. What type of socks are you wearing with the Enhanced Chukka Shoes, and how many pairs of each type do you wear?

○ White athletic socks	number of pairs _____
○ Black issue socks	number of pairs _____
○ Other: _____	number of pairs _____

7. Did you wear additional inserts or cushioning in your Enhanced Chukka shoes?
○ Yes ○ No

If *YES*, explain:

8. A. Rate the Enhanced Chukka Shoe's arch support.
○ Poor ○ Fair ○ Good

B. If *Poor* or *Fair*, please explain:

9. A. Rate the Enhanced Chukka Shoe's ankle support.
○ Poor ○ Fair ○ Good

B. If *Poor* or *Fair*, please explain:

10. Rate your ability to perform the following activities while wearing the Enhanced Chukka Shoe:

Stand.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Walk.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Run.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
March.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Descending Ladders....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Ascending Ladders.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

11. A. Rate the Enhanced Chukka Shoe's traction on the following surfaces:

Wet/Moist.....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Oil Covered (POL).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Waxed (tile deck).....	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Non-skid	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Painted	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Carpet	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Steel Ladder Treads	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A
Smooth Steel Decks	<input type="radio"/> Poor	<input type="radio"/> Fair	<input type="radio"/> Good	<input type="radio"/> N/A

B. Did temperature affect the traction of the shoes?
☐ Yes ☐ No

If YES Please Explain:

12. A. Did your Enhanced Chukka Shoes get wet?
☐ Yes ☐ No

***** IF NO, PROCEED TO QUESTION 13 *****

If YES:

B. Did your Enhanced Chukka Shoes keep your feet dry?
☐ Yes ☐ No

- C. Approximately how long did it take them to dry completely?
☐ 1-3 Hours ☐ 4-6 Hours ☐ 7-9 Hours ☐ 10+Hours

- D. How did you dry them (air-dry naturally, etc.)?
Please explain:

13. Rate the thermal comfort (feet too warm or not warm enough) of the Enhanced Chukka Shoe.
☐ Too Warm ☐ Just Right ☐ Too Cold

If *Too Warm*, are they too warm:

- ☐ All of the time ☐ Some of the time
Explain:

If *Too Cold*, are they too cold:

- ☐ All of the time ☐ Some of the time
Explain:

14. Does the Enhanced Chukka Shoe cause your feet to sweat and stay wet?
☐ Yes ☐ No

15. A. Did the Enhanced Chukka Shoe cause any of the following problems (mark all that apply):
☐ None ☐ Blisters ☐ Foot Cramps ☐ Aching Legs
☐ Callouses ☐ Aching Feet ☐ Aching Back ☐ Other _____

B. Did the problem continue? Please explain.

- C. Did it require medical attention?
☐ Yes ☐ No

If *YES*, explain.

16. How many times did you have to wear the Enhanced Chukka Shoe to break it in?

- ☐ Number of times _____
- ☐ Did not need to be broken-in
- ☐ Cannot be broken-in

17. Did your Enhanced Chukka Shoes get damaged (rips, tears, seams separate, etc.) during the evaluation? ☐ Yes ☐ No

If **YES**, please indicate where on the picture below, and describe the problem.



18. Please rate the look of the Enhanced Chukka Shoe?

☐ 1
*Really
Dislike*

☐ 2

☐ 3
Fair

☐ 4

☐ 5
*Really
Like*

19. List any design features (example: sole, tongue, roll cuff) that you really like.
20. List any design features (example: sole, tongue, roll cuff) that you really dislike.
21. Please give an overall rating of the Enhanced Chukka Shoe.
- | | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 2 | <input type="radio"/> 3 | <input type="radio"/> 4 | <input type="radio"/> 5 |
| <i>Very</i> | | <i>Fair</i> | | <i>Excellent</i> |
| <i>Poor</i> | | | | |
22. Would you purchase the Enhanced Chukka Shoe if given the option?
- ☐ Yes ☐ No
- If *NO*, please explain:
23. Do you have additional comments/recommendations on the Enhanced Chukka Shoe?

Appendix D

RDC Comparison Survey

Enhanced Chukka Shoe Comparison Survey

Date _____

Questionnaire Number _____

1. Last Four _ _ _ _
2. ☐ Male ☐ Female
3. Date Of Birth _____
4. Which Enhanced Chukka Shoe did you prefer?

☐ B ☐ C ☐ Same

Please explain.

4a. Do you prefer this shoe to the standard issue Chukka Shoe (The shoe usually issued to new recruits)?

☐ Yes ☐ No

Please explain.

5. Which shoe did you prefer for the following characteristics:

Fit.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Comfort.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Durability.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Traction.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Thermal Comfort..	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Water Repellency..	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same

6. Which shoe did you prefer while performing the following:

Standing.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Walking.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Running.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same
Marching.....	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> Same

7. Which shoe did you prefer for comfort in the following specific areas:

<u>Ankle:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Toes:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Heel:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Instep(top of foot):</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE

8. Which shoe did you prefer for fit in the following specific areas:

<u>Ankle:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Toes:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Heel:</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE
<u>Instep(top of foot):</u>	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> NO PREFERENCE

9 A. Which Enhanced Chukka Shoe was easier to break in?
☐B ☐C ☐SAME

B. Which Enhanced Chukka Shoe was easier to put on?
☐B ☐C ☐SAME

C. Which Enhanced Chukka Shoe was easier to take off?
☐B ☐C ☐SAME

10. List any design features of the Enhanced Chukka Shoes (example: sole, tongue, roll cuff) that you really like.

Enhanced Chukka Shoe <u>B</u>	Enhanced Chukka Shoe <u>C</u>

11. List any design features of the Enhanced Chukka Shoes (example: sole, tongue, roll cuff) that you really dislike.

Enhanced Chukka Shoe <u>B</u>	Enhanced Chukka Shoe <u>C</u>

12. Which shoe would you purchase?

B only

C only

Either one

Neither

13. Please rate how easily you were able to produce a shine for military-appearance on:

A. The BATES shoe

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

Very

Very

Difficult

Easy

B. The CRADDOCK - TERRY shoe

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

Very

Very

Difficult

Easy

C. Any further comments pertaining to the care and maintenance of either boot?

14. Do you have additional comments/recommendations on the Enhanced Chukka Shoes?

Appendix E

Recruit Demographic and Issue Questionnaire

Demographic Sheet

Date _____

Last Four - - - - B C

Date Of Birth _____

☐ L ☐ R

☐ Male ☐ Female

Race: ☐ American Indian ☐ Asian
☐ Afro-American ☐ Caucasian
☐ Hispanic

1. Do you have any foot problems? ☐ Yes ☐ No
If Yes, explain.

2. Measured (Brannock Device) Shoe Size:

Left: length _____ width _____

Right: length _____ width _____

3. a. Issued Enhanced Chukka Shoe Size: length _____ width _____
Rate the fit: ☐ Too Loose ☐ Just Right ☐ Too Tight

b. If issued shoe size **did not** fit properly, and another size was issued:
2nd Issued Enhanced Chukka Shoe Size:

length _____ width _____

Rate the fit: ☐ Too Loose ☐ Just Right ☐ Too Tight

List any other shoe sizes that were tried, and rate the fit (as done above).

c. If the test participant could not be properly fit with a shoe, explain why it was not possible.

4. Fitted by: _____

5. Measured by: _____

Appendix F

Turn In and Reissue Data Form

Turn In and Reissue Sheet

IF SHOES HAD TO BE EXCHANGED FOR ANOTHER SIZE AFTER BEING WORN, PLEASE COMPLETE THE FOLLOWING:

Date _____

Last Four ____-____-____-____ B C

☐ Male ☐ Female

Date Of Birth _____

-
1. Date shoes were turned-in _____.
 2. Size of shoes being turned-in _____.
 3. Reason for turn-in: _____
 4. Number of days the Enhanced Chukka Shoes were worn _____.
 5. If test participant was re-measured:
Measured (Brannock Device) Shoe Size:
Left: length _____ width _____
Right: length _____ width _____
 6. Re-Issued Size of Enhanced Chukka Shoe: length _____ width _____
Rate the fit: ☐ Too Loose ☐ Just Right ☐ Too Tight
-
7. Fitted by: _____
 8. Measured by: _____

Appendix G

Summary Data by ECS and Survey Number

**Summary Data by Enhanced Chukka Shoe and Survey Number
for Three-Point Scales**

Rating Scale:	1=POOR			2=FAIR		3=GOOD	
	BATES			CRADDOCK-TERRY			
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3	
Arch Support	$\bar{x}=2.44$ SD=.66 N=126	$\bar{x}=2.33$ SD=.67 N=120	$\bar{x}=2.39$ SD=.69 N=117	$\bar{x}=2.40$ SD=.68 N=108	$\bar{x}=2.13$ SD=.78 N=109	$\bar{x}=2.14$ SD=.75 N=115	
Ankle Support	$\bar{x}=2.68$ SD=.55 N=127	$\bar{x}=2.67$ SD=.56 N=120	$\bar{x}=2.72$ SD=.58 N=116	$\bar{x}=2.72$ SD=.53 N=107	$\bar{x}=2.68$ SD=.56 N=110	$\bar{x}=2.64$ SD=.58 N=114	

**Summary Data by Enhanced Chukka Shoe and Survey Number
for Three-Point Scales**

Rating Scale: 1=TOO TIGHT 2=JUST RIGHT 3=TOO LOOSE						
	BATES			CRADDOCK-TERRY		
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
Overall Fit	$\bar{x}=2.03$ SD=.38 N=126	$\bar{x}=2.06$ SD=.45 N=121	$\bar{x}=2.09$ SD=.38 N=117	$\bar{x}=2.02$ SD=.31 N=105	$\bar{x}=1.97$ SD=.44 N=110	$\bar{x}=2.06$ SD=.45 N=114
Ankle Fit	$\bar{x}=2.05$ SD=.36 N=125	$\bar{x}=2.01$ SD=.34 N=118	$\bar{x}=2.09$ SD=.40 N=116	$\bar{x}=2.07$ SD=.40 N=107	$\bar{x}=2.07$ SD=.42 N=106	$\bar{x}=2.15$ SD=.43 N=114
Toes Fit	$\bar{x}=1.95$ SD=.44 N=124	$\bar{x}=1.92$ SD=.53 N=118	$\bar{x}=1.93$ SD=.49 N=117	$\bar{x}=1.92$ SD=.46 N=107	$\bar{x}=1.79$ SD=.53 N=107	$\bar{x}=1.92$ SD=.52 N=115
Heel Fit	$\bar{x}=2.14$ SD=.39 N=123	$\bar{x}=2.15$ SD=.44 N=117	$\bar{x}=2.10$ SD=.33 N=116	$\bar{x}=2.15$ SD=.45 N=107	$\bar{x}=2.11$ SD=.44 N=106	$\bar{x}=2.17$ SD=.44 N=113
Instep Fit	$\bar{x}=2.06$ SD=.34 N=126	$\bar{x}=1.97$ SD=.39 N=115	$\bar{x}=2.00$ SD=.37 N=115	$\bar{x}=1.93$ SD=.38 N=106	$\bar{x}=1.97$ SD=.38 N=106	$\bar{x}=1.94$ SD=.41 N=113
Rating Scale: 1=TOO WARM 2=JUST RIGHT 3=TOO COLD						
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
Thermal Comfort	$\bar{x}=1.78$ SD=.44 N=116	$\bar{x}=1.69$ SD=.47 N=118	$\bar{x}=1.72$ SD=.49 N=116	$\bar{x}=1.88$ SD=.45 N=105	$\bar{x}=1.68$ SD=.51 N=107	$\bar{x}=1.75$ SD=.44 N=114

**Summary Data by Enhanced Chukka Shoe and Survey Number
for Four-Point Scales**

Rating Scale: 1=Easy 2=Fairly Easy 3=Fairly Difficult 4=Difficult						
	BATES			CRADDOCK-TERRY		
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
Donning the ECS	$\bar{x}=1.49$ SD=.63 N=128	$\bar{x}=1.52$ SD=.58 N=122	$\bar{x}=1.45$ SD=.53 N=117	$\bar{x}=1.94$ SD=.73 N=108	$\bar{x}=2.13$ SD=.64 N=110	$\bar{x}=2.05$ SD=.68 N=117
Doffing the ECS	$\bar{x}=1.47$ SD=.60 N=126	$\bar{x}=1.45$ SD=.55 N=121	$\bar{x}=1.46$ SD=.52 N=117	$\bar{x}=1.84$ SD=.69 N=107	$\bar{x}=1.91$ SD=.55 N=110	$\bar{x}=1.89$ SD=.63 N=117

**Summary Data by Enhanced Chukka Shoe and Survey Number
for Five-Point Scales**

Rating Scale: 1=Very Poor 3=Fair 5=Excellent						
	BATES			CRADDOCK-TERRY		
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
Overall Rating of ECS	\bar{x} =4.04 SD=.67 N=117	\bar{x} =4.01 SD=.67 N=120	\bar{x} =3.94 SD=.78 N=114	\bar{x} =3.93 SD=.73 N=103	\bar{x} =3.62 SD=.73 N=108	\bar{x} =3.76 SD=.78 N=110
Rating Scale: 1=Very Poor 3=Fair 5=Excellent						
	Survey #1	Survey #2	Survey #3	Survey #1	Survey #2	Survey #3
"Look" Rating of ECS	\bar{x} =4.45 SD=.71 N=127	\bar{x} =4.36 SD=.77 N=115	\bar{x} =4.37 SD=.73 N=115	\bar{x} =4.31 SD=.73 N=105	\bar{x} =4.22 SD=.80 N=105	\bar{x} =4.03 SD=.97 N=115

Appendix H

Medical Information for Each ECS

Medical Information for each ECS type

Medical personnel were sought for the following problems:

Bates:

Blisters (N=3)

Ankle/foot pain (N=3)

Ingrown toenail (N=2)

Knee pain (N=2)

Sore feet (N=1)

Craddock-Terry:

Ankle pain (N=10)

Sore feet (N=6)

Blisters (N=4)

Chronic sore feet (N=2)

Appendix I

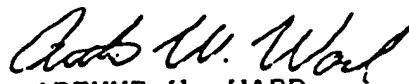
Memorandum from Medical Personnel

30 MAY 1996

TO WHOM IT MAY CONCERN;

THIS LETTER IS IN REGARD TO THE TWO NEW PAIRS OF BOOTS THAT WERE WEAR TESTED AT THE RECRUIT TRAINING CENTER GREAT LAKES, ILLINOIS OVER THE LAST THREE MONTHS. IN ADDITION TO THE FOUR DIVISIONS OF RECRUITS AND RECRUIT DIVISION COMMANDERS WHICH WORE THEM, MYSELF AND TWO OTHER GENERAL MEDICAL OFFICERS WORE BOTH PAIRS OF BOOTS. AFTER THE TEST WAS COMPLETED MYSELF AND THE TWO GENERAL MEDICAL OFFICERS MET TO DISCUSS THE NEW BOOTS AND FILL OUT OUR SURVEYS. WE UNANIMOUSLY FELT THAT BOTH PAIRS OF NEW BOOTS WERE FAR SUPERIOR TO THE BOOTS CURRENTLY IN USE. THE NEW BOOTS SEEMED TO BE OF A HIGHER QUALITY MATERIAL, AND BETTER CONSTRUCTION AND DESIGN. THE LEATHER UPPER PART OF THE BOOT WAS VERY SOFT AND SUPPLE AND TOOK PRACTICALLY NO BREAK IN TIME, IT FELT LIKE IT WAS ALREADY BROKEN IN THE FIRST TIME THE BOOTS WERE WORN. THE PADDING AT THE TOP OF THE BOOT, AROUND THE ANKLE, WAS ALSO VERY COMFORTABLE AND ADDED SUPPORT TO THE ANKLE JOINT. THE INSOLES AND PADDING ON THE INSIDE OF THE BOOTS WERE EXCELLENT. THIS SHOULD AID IN KEEPING THE FOOT DRY, COMFORTABLE AND WARM IN COLD WEATHER CONDITIONS. ANOTHER IMPROVEMENT IS THAT THE NEW BOOTS COME IN WOMEN'S SIZES TO FIT THEIR FEET INSTEAD OF MEN'S BOOTS TO FIT THEIR FEET WHICH IS CURRENTLY BEING USED.

FROM A MEDICAL STANDPOINT NONE OF THE THREE HEALTH CARE PROVIDERS DEVELOPED ANY BLISTERS, ABRASIONS OR FOOT PAIN WHILE WEARING THE NEW BOOTS NOR DID THERE APPEAR TO BE ANY INCREASED INCIDENCE OF FOOT COMPLAINTS FROM THE RECRUITS WEARING THE NEW BOOTS.


ARTHUR W. WARD
LCDR, USN, MSC
STAFF PODIATRIST
RTC GREAT LAKES